

The freight market forecast predicts a doubling of the jet freighter fleet over the next 20 years, with a larger increase in the number of widebody freighters. If the forecast is accurate, the majority of remaining A310s, A300-600s, 767-200s/-300s, MD-11s and 747-400s will be converted.

How large will the widebody freighter market be?

Passenger to freighter programmes for the A310, A300-600, 767, MD-11 and 747-400 are all now available, following Cathay Pacific's launch of Boeing's 747-400SF programme. The values of all these types are now low enough for these aircraft to be converted over the next few years, but the longer term issue of what the demand for widebody freighters will be over the next 10 and 20 years is more significant.

Since it is unlikely that more DC-10s and 747 Classics will be converted, this leaves the market to just these five main types. Despite recent years of recession, freight traffic growth is high both globally and in most main regions. This implies that the growth in the world freighter fleet will be proportionate to the increase in traffic. The growth in the passenger widebody fleet, however, provides airlines and freight forwarders with a large volume of freight capacity, and so lessens the need for an increase in pure freighters in the fleet.

Market forecast

Prior to 2001, global freight grew by 6-7% annually, but a traffic slump followed in 2001 and 2002. In fact, 2001 was the worst year for air freight for about 30 years. Global traffic declined by 6% as a result of the collapse in some hi-tech industries, an economic slowdown in many parts of the world and the terrorist events of September 11th.

A turnaround was recorded in 2002, with an annual increase in traffic of 6.5%. This was stronger than the predicted rise of 3% and left traffic volumes similar to those of 2000.

A slower recovery continued in 2003 with a 1.1% increase in traffic. This small rise was due to the war in Iraq, the SARS virus in the Asia Pacific and slower than anticipated economic recovery.

The global economy is now

improving. It grew at an annual adjusted rate of 2.4% for the first nine months of 2003, and is expected to grow by 3.3% in 2004.

One main stimulant of air freight traffic growth is the growth in the semiconductor industry. As Tom Hoang, regional director cargo marketing at Boeing points out, "Positive growth in the industry leads to growth in air freight, since computers and their components are both high value and time sensitive. A high level of replacement of computers by large corporations is now likely, since the last large major replacement cycle was in 1999 just prior to Y2K."

Hoang says an overall improvement in the air freight business is expected in 2004. Boeing's long-term prediction is an average annual growth rate of 6.4% over the next 20 years. This would more than treble freight volumes, but not require a trebling of the freighter fleet.

Current widebody fleet

Most forecasters break the widebody fleet into medium and large widebodies. The first category includes the A310-300, A300-600, 767-200 and 767-400. The large category includes the MD-11 and 747, but also the ultra-large A380.

Although only six types are now the consideration of freight airlines, the probable availability of conversion programmes for the A330, A340 and 777 over the next 20 years will also become an issue, and take a portion of the potential market.

The fleet of western jet freighters is about 1,752 aircraft, including 315 medium and 400 large widebodies.

The medium widebody fleet includes a wide variety of types. There are about 120 older generation A300B2/4s, L-1011s and DC-10s, and about 66 767-200s/-300s, 50 A310s and 80 A300-600s.

All 767-200Fs have been added to the fleet in recent years, with converted

aircraft operated by ABX accounting for the majority. A few more passenger 767-200s are parked awaiting conversion. Most 767-300Fs are factory-built aircraft operated by UPS.

Most of the 80 A300-600Fs are also factory-built aircraft, ordered by FedEx and UPS. A few, however, are converted.

There are 44 A310-200Fs in operation, all of which are owned by FedEx. Several more A310-200s are parked awaiting conversion and subsequent operation by FedEx.

Only six A310-300s have so far been converted, including two for FedEx. Several more are parked awaiting conversion to freighter.

The large widebody fleet consists of about 96 MD-11s, 90 747-400s and almost 220 747-100s/-200s. There are a further 96 MD-11s in passenger configuration, although some are already earmarked for conversion and subsequent operation by UPS. More aircraft may be converted and used by FedEx.

Future widebody fleet

Taking into consideration the belly space provided by widebody passenger aircraft, Boeing's market forecast is for a fleet of about 3,500 western jet freighters, including 980 medium widebodies and 980 large widebodies. Interestingly, the forecast predicts the two widebody categories will account for the largest portion of the global fleet in the future.

This predicted fleet growth is a net increase of 665 medium widebodies and 580 large widebodies, and a net increase of 1,750 for the whole fleet. Retirements from the current fleet have to be accounted for. Hoang says Boeing forecasts that a total of 2,976 aircraft will be required for both growth and replacement, with 1,475 of the current fleet of 1,752 expected to retire.

The current medium widebody fleet



can be broadly split into two: older generation A300B2/4, L-1011 and DC-10, of which there are 120; and 196 younger types, which are the 767-200/-300, A300-600 and A310-300. All 120 of the older generation can be expected to retire over this period. Given that some of the A310-200s/-300s and 767-200s are now in the region of 20 years old, some of these are also likely to retire. The majority of A300-600 and 767-300 freighters are factory-built aircraft. Since they entered service with FedEx and UPS in 1993 and 1994, they may be retired by 2022 or soon after.

At least 200 medium widebodies could therefore retire, meaning there will be a market for 865 widebody freighters over the next 20 years.

This market would be available to the A310-200/-300, A300-600 and 767-200/-300. If conversion programmes become available for the 767-400 and A330-200 they would compete for this category, but many are unlikely to be converted for another 15 years.

The large widebody fleet can also be split into two halves: the 217 747-100s/-200s and 186 747-400s and MD-11s. All 747-100s/-200s can be expected to be retired; most of them over the next 10 years. The older MD-11s are now more than 10 years old, and so may come due for retirement towards the end of the 20-year period. The aircraft's uniqueness, however, may see the MD-11s being kept in operation for longer. Some of the oldest 747-400Fs are also about 10 years old, and so may be retired before 2022. This implies the market for large widebody freighters would be at least 800 aircraft.

Hoang says Boeing estimates that about 75% of all aircraft will be converted passenger models, with the

remainder being new factory-built aircraft that have aircraft utilisations and yields high enough to justify them. If applied to the medium widebody and large widebody fleets, there will be a requirement for about 650 converted medium widebodies and 600 converted large widebodies over 20 years.

Airline strategies

Besides macro-economic analyses, it is also prudent to examine the strategies of major freight airlines around the globe.

The US market accounts for about 50% of the total. The US market can basically be divided between the integrators carrying express freight and non-integrators. There has been considerable consolidation of US integrators in the past five years, with the exit of Emery. The main remaining airlines are United Parcel Service (UPS), FedEx, Astar Air Cargo and Airborne Express (ABX). It is predicted that further consolidation could result in only three airlines remaining.

Although express package freight has historically benefited from high growth rates, the past years have seen these diminish as a result of e-commerce and weaker economies. These airlines have therefore been forced to accept general freight and lower yields, which could possibly result in a new strategy of maintaining aircraft capacity or even reducing it in some cases. Replacement of 727s and DC-8s may not be totally accomplished with larger aircraft.

Airlines carrying express freight have long established air route networks which adequately provide delivery of packages within the times guaranteed. This negates the requirement for more flight

Cathay Pacific has launched Boeing 747-400 passenger-to-freighter conversion programme. Market forecasts indicate that up to 600 large widebody freighters could be required over the next 20 years. There are about 500 747-400s in passenger configuration, which suggests the majority could be converted.

frequencies on existing routes. Airlines therefore generally have a strategy of increasing aircraft size on existing routes as traffic grows, and putting their smallest aircraft on new routes as they are opened when a critical volume of traffic has been reached. Integrators can therefore follow a general policy of maintaining fleets of different-sized aircraft and replacing aircraft on particular routes with larger types over the long term.

This has been the policy of UPS, which operates a fleet ranging from the 727-100 to the 747-100/-200. UPS has ordered only widebodies in recent years, and has outstanding commitments for A300-600s and MD-11s, which will be used to replace the 757 and DC-8-73, which in turn will replace the 727-100. UPS's outstanding orders are sufficient to satisfy its requirements for several years, and so it is unlikely to place further orders for widebodies for several years.

FedEx has a similar fleet profile, but has added few widebodies in recent years. It cancelled about half of its MD-10 orders and also froze conversions of A310-300s. FedEx's large fleets of A310-300s, A300-600s and MD-11s indicate the types of widebodies it could order if it were to require more in the future, but there remains some doubt about whether it actually needs to acquire larger aircraft. There is speculation that the 757 or 737 could in fact suit its needs more closely if it were to follow a strategy of maintaining or downsizing capacity.

The acquisition of ABX by DHL has led to speculation about whether or not DHL will decide to use just one airline to provide its air services, or continue with both ABX and Astar.

There are several non-integrator freight carriers in the US. The major airlines are Arrow Air, Florida West, Gemini Air Cargo, Evergreen and Atlas Air. Except for Arrow Air, all these are pure widebody operators. Florida West, which is majority owned by Lan Chile Cargo, operates 767s and is experiencing high load factors and growth rates. This indicates that it is likely to require more 767s in the future, although it is a small carrier.

The other three all operate the MD-11 or 747, but have had little traffic growth in recent years. Atlas Air has, in fact, parked several aircraft. Resumed

The majority of A300-600Fs now in operation are factory-built freighters. The demand for medium-widebody freighters over the next 20 years could approach 900 units, meaning supply of passenger-configured A300-600s would be exhausted.

traffic growth would put these aircraft back into operation, and further growth would create a need for more aircraft. Evergreen and Atlas Air are both likely candidates for the 747-400 in the future, with aircraft values being the most likely determinant of timing of acquisition.

Europe's major freight carriers are express freight airlines European Air Transport and TNT, and general freight carriers Lufthansa Cargo, Air France Cargo, Cargolux, Martinair and Channel Express. All, except for TNT, operate widebodies of varying sizes, and all are probable candidates for widebodies.

DHL and TNT are the most likely candidates for medium widebody types.

Lufthansa Cargo has recently become an all-MD-11 operator, while Cargolux has become an all-747-400 airline and is acquiring one aircraft about every 12 months. Air France Cargo also operates an all-747-400 fleet. Martinair operates both MD-11s and 747-200s, and is considering possible acquisition of converted 747-400s.

The Asia Pacific will be one of the largest markets for widebody freighters over the next 10 and 20 years. Major freight operators include Cathay Pacific, Air Hong Kong, Korean Air, Asiana Cargo, Air China Cargo, China Airlines, EVA, Singapore Airlines and Maskargo. All of these airlines are 747 operators, although Air Hong Kong has also acquired some A300-600s to operate some intra-Asian express package services for Cathay Pacific Cargo. These airlines have all ordered large numbers of factory-built 747-400s in recent years, although the move by Cathay Pacific to converted aircraft may now be repeated by other airlines.

There is little indication that these major freight operators will opt for small types in the short term, but high traffic growth rates in the region and in China may lead to other airlines requiring medium widebody types in the future.

Africa and the Middle East are smaller markets, although Emirates has acquired a single 747-400F in recent years and Qatar Airways has contracted to convert some of its A300-600s. If both airlines' passenger growth rates are to be taken as an indication of their progress in the freight sector, they could become significant freight carriers over the coming years, and be potential customers



for various widebody types.

DHL's operation in the Middle East has experienced annual growth rates of 45-50% in the past two years. The airline, based in Bahrain, operates 727-200s, A300s and a variety of turboprops, but has said it will increase its capacity if growth continues, although it is not sure with what aircraft types.

DAS Air Cargo of Uganda has grown significantly over the past 10 years, and has more recently seen traffic growing at about 7% per annum. It currently operates six DC-10-30s, but is aiming to add MD-11s and would like to replace all its DC-10s with the larger aircraft.

Some dominant airlines have begun to emerge from Latin America over the past five years. Lan Chile Cargo and its two other partners ABSA and Masair operate a small fleet of 767s, but these operate at utilizations as high as 5,000 flight hours per year and with load factors exceeding 90%. They fly an intra-Latin American network and other routes to the US and Europe. In some cases growth rates have been as high as 30%, and all indications are that these airlines will require regular additions of widebodies to their fleets.

Tampa Cargo of Colombia has five DC-8s, but has already opted to replace these with 767-200s. Further traffic growth may lead to more frequencies on its network, leading to more aircraft.

Aircraft availability

The predicted 600 medium widebody freighter conversions should be compared to the passenger fleets. The smallest fleet is the A310-200, with only 32 remaining. Some are parked aircraft owned by FedEx. Given the age of other A3100-200s and the low market values of the

longer range A310-300, no other -200s are likely to be converted. There are 137 A310-300s still in passenger configuration, some of which are awaiting modification to freighter. The last A310-300 was built in 1994.

The fleet of A300-600s is also limited, with 30 shorter-range -600s operated by Saudia, Thai and Lufthansa. This leaves 150 longer-range -600Rs, which are more appealing to freight operators. The youngest A300-600R is only two years old, although most aircraft were built in the late 1980s and early 1990s.

There are 193 767-200s in passenger configuration, a small number of which are already earmarked for conversion and subsequent operation by Tampa Cargo and other carriers. The last -200 was built in 2001, although most were constructed prior to 1990. There are many gross weight variants, but these can be standardised down to two during modification. These will be attractive aircraft to freight airlines, until values of 767-300s fall to low enough levels so that total acquisition and modification costs are equal to those of the -200.

The largest fleet available for modification is the 767-300, with 590 aircraft in service. Many of these were built prior to 1995, although the 767-300 is still in production. Besides the 767-300's potential to make a good freighter, it will also remain popular with passenger carriers. A large portion of the better A310-300s, A300-600s and 767-200s will therefore be converted to fill the market, but this would leave about half the predicted 600 conversions to be filled by the 767-300.

The total of passenger 747-400s and MD-11s is about 610 aircraft, which is close to the predicted market of 600



converted aircraft. Virtually all MD-11s are expected to be converted, and the commitment that UPS has made to the aircraft indicates that supply of passenger models will diminish fast. Conversion programmes for the A330-300, A340 and 777 could satisfy some demand in this category in later years, especially when all MD-11s have been converted.

This will leave the remainder of the market to be filled by the 747-400. Not all aircraft are suitable conversion candidates, since their wing type is not strong enough. This leaves about 425 suitable aircraft, although some have Rolls-Royce engines which may not be so attractive to airlines because of their higher weight and subsequent lower payload. This further implies the supply of better quality 747-400s could be exhausted by conversions to freighter.

Converted freighters

The MD-11 and 747-400 currently are both in classes of their own, and have no direct competitors.

The A310-300 and A300-600 clearly compete with the 767-200 and 767-300.

In the case of each aircraft, it is prudent to analyse their total build costs, or costs of making them serviceable as converted freighters, as well as their payload capacities. In each case, current market value, conversion and freight handling installation and additional maintenance have to be considered.

The A310-300's market values have now dropped to less than \$10 million. Cost of conversion may be in the region of \$7.5 million, with an additional \$4.5 million for maintenance to take total investment to about \$22 million. Possible discounts on conversion and reductions

in values could reduce this by a further \$3-4 million. The A310-300 has a containerised volume of 10,350 cubic feet and structural payload of 86,300lbs, which allow a maximum packing density of 8.3lbs per cubic foot. Range with maximum payload is 3,350nm.

Values of the oldest 767-200s have now dropped below \$8 million, although this is for the lower gross weight and shorter-range examples. There are in fact 16 different gross weight variants between 280,000lbs and 395,000lbs, with the 351,000lbs model being the most numerous. Gross weight can, however, be upgraded during conversion to just two options for the -200. The higher weight option can carry 93,400lbs up to 3,200nm. Values of the -200ER are higher, given their lower availability on the used market.

Cost of conversion to freighter is about \$8.6 million, and a further \$4 million would be needed for aircraft in a reasonable maintenance condition. This would take total investment to about \$21 million, similar to the A310-300.

The 767-200 has a containerised volume of 13,014 cubic feet. Structural payloads for the two models are 93,400lbs and 101,400lbs, and have maximum packing densities of 7.2lbs and 7.8lbs per cubic foot. The 767-200 thus provides a higher freight capacity than the A310-300. The 767-200ER will further provide a range advantage when they are converted.

Values of A300-600s are still relatively high at \$20 million, and together with a conversion cost of about \$8.5 million and added maintenance of \$4-5 million total investment is taken to about \$30 million. This is currently too high compared to the acceptable monthly

The high demand for MD-11s from carriers like Lufthansa Cargo and UPS means all remaining passenger aircraft will be converted over a short period. This will leave a capacity gap in the market between the 767-300 and 747-400 over a sustained period, until a conversion programme for the A340 or 777 becomes available.

lease rate of \$260,000. Values must drop to less than \$15 million, which will occur when availability increases following retirement.

The A300-600 has a total volume of 14,000 cubic feet and structural payload of 109,740lbs with range of 2,650nm.

Values of the oldest 767-300s have reached about \$25 million, although a resurgence in traffic means values are improving again. Costs of conversion and maintenance are similar to the A300-600, taking total investment for a 767-300 converted freighter to \$38 million, which will be too high for freight operators. Values will need to fall to about \$15 million for the economics of conversion to be acceptable.

The 767-300 has a containerised volume of 15,900 cubic feet and structural payload of 113,900lbs, making it larger in capacity than the A300-600.

Values of 10-15 year old MD-11s are in the region of \$30 to \$45 million. Cost of conversion is about \$9 million, with a further \$1 million for a freight loading system. Additional maintenance can be as high as a further \$5 million. This will take total investment to \$45-60 million, but this can be amortised over an expected life of at least 25 years.

The MD-11 is in a size class of its own, with a structural payload of 189,000lbs, containerised volume of 20,116 cubic feet, and corresponding range of 4,000nm.

The passenger-to-freighter conversion modification for the 747-400 has recently been launched by Boeing, although Bedek Aviation is also in the process of launching its own programme. The 747-400 will be economically acceptable to most freight carriers at a lease rate of \$550,000-600,000 per month, implying that total build cost for a converted aircraft could not be higher than \$54 million. Values of older 747-400s are in the region of \$30-35 million.

Modification costs for either programme are not expected to exceed \$20 million, but additional maintenance, such as a D check and engine shop visits, could reach as much as \$9 million, although this would reduce the negotiated price for the aircraft. This implies that the aircraft are just becoming economic to convert.

The 747-400 will have a structural payload of 253,000lbs and containerised volume of 20,600 cubic feet. **AC**